THE SURGICAL TREATMENT OF DIVERTICULITIS
OF THE COLON*

ALLEN M. BOYDEN, M.D.

PORTLAND, OREGON

DIVERTICULITIS OF THE COLON has been traditionally regarded as a condition to be treated conservatively. Surgical textbooks and surgical teaching have long advised against a radical approach to this condition, operative intervention being reserved only for those patients who develop abscess, peritonitis, obstruction, or fistula. In the event of these complications, the common practice has been the employment of the most conservative surgical measures in the hope that diverticulitis will not recur.[1-15] Simple drainage of abscesses with or without colostomy has been customary. In case of obstruction or fistula (cutaneous or vesicocolic) colostomy has been advocated, the fecal shunt being maintained for three to 12 months in order to place the involved bowel at rest. After such prolonged periods of decompression it has been common practice to close the fistula and re-establish bowel continuity without removal of the diseased segment.

This conservative attitude was advocated in the era prior to the introduction of chemotherapy and the antibiotics and resulted from the high mortality rate reported when resection was undertaken. Since 1941, a few reports[16-20] have decried the poor end-results from conservative surgery in complicated diverticulitis and have suggested performance of earlier curative resection. However, conservatism has persisted despite the fact that measures short of resection have yielded prolonged morbidity and distressingly high recurrence rates. It has continued in many clinics without regard to the marked reduction in mortality following resection, reported in the recent literature.[17, 19] Furthermore, the great strides of recent years in the reduction of morbidity and mortality following surgical treatment for carcinoma of the colon have been largely disregarded in the re-evaluation of surgical therapy in diverticulitis.

However, many patients with diverticulitis, both in the acute phase of the disease and in the more chronically complicated stages of obstruction or fistula, require early resection because of the difficulty in ruling out carcinoma. This diagnostic problem is well illustrated by two case reports from the Massachusetts General Hospital.[21] One patient, observed for a long period under the diagnosis of diverticulitis, proved eventually to have hopeless carcinoma of the sigmoid. A second patient with both clinical and roentgen evidence of carcinoma underwent early resection for a lesion which proved to be diverticulitis.

During a recent ten months' period three patients came under my

observation in whom the diagnosis of carcinoma of the sigmoid could not be ruled out prior to pathologic examination. In two of these patients, from the clinical findings, the diagnosis of diverticulitis seemed most likely. One presented the typical inflammatory picture so common in this disease, while the other had developed a spontaneous vesicosigmoidal fistula. However, roentgen evidence of cancer was found in both (Figs. 1 and 2). The third patient was admitted with large bowel obstruction, requiring colostomy decompression. Abdominal exploration at that time revealed a large rectosigmoidal mass, appearing grossly malignant. In two of these cases diverticula were not

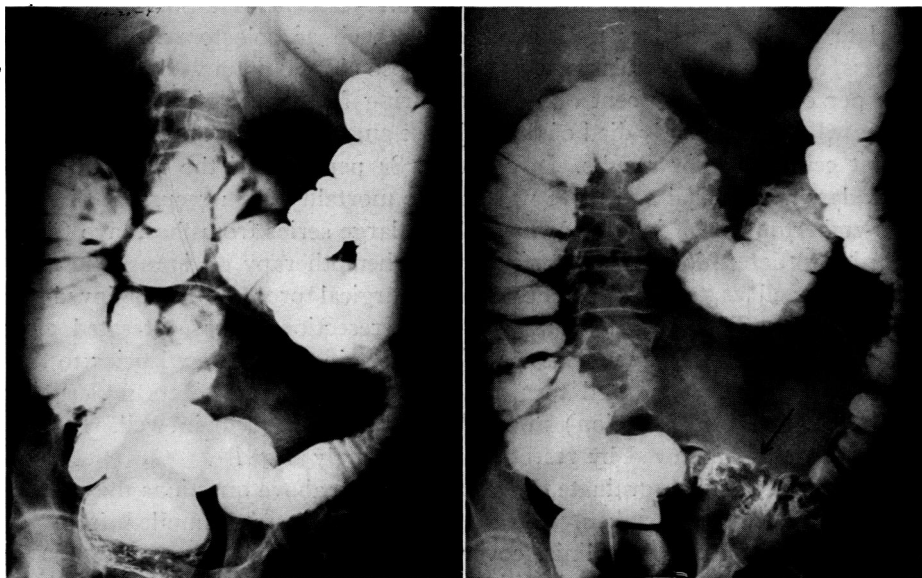

FIG. 1   FIG. 2

FIG. 1.—Barium enema showing persistent defect in sigmoid colon. No diverticula are seen. The clinical picture suggested diverticulitis. Palpable mass in left lower quadrant. Roentgen ray consultant could not rule out cancer.

FIG. 2.—Barium enema showing annular defect of sigmoid colon. Numerous diverticula are seen. Roentgen ray consultant could not rule out cancer, although diverticulitis was suspected. The clinical picture is that of spontaneous vesicosigmoidal fistula of four weeks' duration

demonstrated by roentgen ray. Resection of the involved segment was performed in each instance, the first two in one stage and the third after preliminary colostomy. At operation all of the lesions appeared grossly malignant, the true condition not being apparent until the bowel had been examined by the pathologist. Carcinoma was found in none.

This experience pointedly raised a number of questions regarding the traditional therapy in this disease. If early resection can be done successfully in cases in which the diagnosis of carcinoma is falsely made, should it not be considered as well in the majority of complicated diverticulitis cases? Is the mortality from resection prohibitive? Is the chronic morbidity incident to

prolonged colostomy drainage necessary? What are the late results following resection as compared to less radical measures?

The answers to these questions are not immediately apparent. Since the disease is comparatively rare it is difficult for any individual to accumulate enough personal experience to permit divergence from the accepted pathways of treatment. However, two large series have been reported in recent years which throw light on some of these problms. Smithwick,[17] in 1942, reviewed a 15 years' experience from the Massachusetts General Hospital. He reported 64 cases of surgically treated diverticulitis, in 33 of which resection had been performed with two deaths, a mortality of 6.1 per cent. He pointed out that the late results from less radical measures, such as colostomy, drainage of abscess, or closure of fistulas, were poor. Those classed as unwell amounted to 47.5 per cent, 78.9 per cent of these requiring further surgical intervention. Those who subsequently died of their disease amounted to 12.5 per cent. Thus, 60 per cent had poor results. In contrast, 84 per cent of the resected cases were classified as well and there was no late mortality from recurrent disease.

Pemberton et al.[19] in 1947 compared two large series from the Mayo Clinic in order to determine the effect of modern chemotherapy on immediate mortality, as well as to appraise the various surgical procedures employed for diverticulitis. The immediate mortality for resection in cases treated after 1940 was 2.7 per cent in contrast to 16 per cent in those treated prior to that date. They further reported that only one-third of the patients undergoing colostomy (without resection) and subsequent closure remain well. Preliminary colostomy followed by resection was strongly urged.

In order to further evaluate the answers to the above questions the present review has been undertaken. The data here presented, compiled from the records of The Portland Clinic, cover a 20-year period (1929 to 1949) in which 37 patients with diverticulitis were treated surgically. Many patients with acute diverticulitis were treated conservatively and did not require surgery. These cases are not included in this review. All cases of carcinoma of the colon have been excluded. Although the work of five surgeons is represented, the majority of the patients were operated on by the late Dr. Thomas M. Joyce. It is interesting to note that Doctor Joyce treated this disease by early attack on the diseased segment of bowel, commonly by primary resection. He did not practice prolonged colostomy drainage. The resultant decrease in morbidity has been an illuminating feature of the present study. Twenty-six of the 27 patients whom he personally treated underwent resection, the remaining patient being referred to him for colostomy closure with no demonstrable residual diverticulitis. It has been gratifying to find that the results obtained completely justified his practice.

INCIDENCE AND DISTRIBUTION

Diverticulosis of the colon occurs in approximately 5 per cent of people over 40 years of age.[9] It is also estimated that approximately 10 per cent of these develop diverticulitis,[9] and further, that of those with diverticulitis,

about 10 per cent will require surgical intervention.[17] This means that approx-
imately 1 in 2,000 people over 40 years of age come to operation for this
disease. It is obvious that few surgeons will acquire an extensive experience
in its treatment.

Diverticulosis may occur throughout the colon (14.4 per cent), but is most
commonly seen in the sigmoid and rectosigmoid (72.0 per cent).[22] The
cecum is involved in 4.8 per cent, the rectum in 2.4 per cent.[22] The incidence
of inflammation in diverticula above the level of the sigmoid is rare. Smith-
wick[17] mentioned only two cases treated at the Massachusetts General Hos-
pital in a 15-year period, the lesions occurring in the cecum and ascending
colon, respectively. In the 20-year period covered by this report two cases
involving the cecum and one involving the ascending colon were encoun-
tered. The latter case is of particular interest since acute perforation of a
diverticulum of the ascending colon requiring resection occurred two years
after resection of the sigmoid for diverticulitis.

TABLE I.—*Age by Decades—35 Cases of Sigmoid Diverticulitis Undergoing Surgery.*

Decades	Cases	Per Cent of Cases
40–49	7	20
50–59	13	37.2
60–69	9	25.7
70–79	6	17.1
Total	35	100

CLINICAL PICTURE

In a collective review, Smithwick[17] found over 87 per cent of the cases
occurring in the fifth, sixth, and seventh decades of life. Thirty-five cases of
sigmoid diverticulitis occurred in the series under consideration. The average
age was 58.6 years at the time of operation. The youngest was 40 years of
age, the oldest 78. Table I shows the incidence by decades. Two-thirds of the
patients were over the age of 55. The three patients with involvement of the
right side of the colon were 29, 35, and 54 years of age, respectively.

Although the sex incidence in collected series shows that the disease is
more common in men than in women, the present series includes 19 men
and 18 women.

The symptoms and signs which the patients presented are summarized in
Table II. The heading of inflammation includes such findings as fever, chills,
tenderness, rigidity, and leukocytosis. Twenty-three of the cases (67.6 per
cent) fell into this category. Hemorrhage occurred in four patients, and was
the presenting symptom in three. Diarrhea was noted in seven. An abdom-
inal or pelvic mass was palpable in 50 per cent of the patients. Fistulas were
present in only three, a lower incidence than commonly reported. Complete
or partial intestinal obstruction was encountered in 11 patients, in seven of
whom colostomy was necessary. In one case, small bowel obstruction devel-
oped due to adhesion to a perforated diverticulitis. Release of adhesions gave

relief, but recurring bouts of diverticulitis required resection eight months later.

The majority of cases of diverticulitis are diagnosed without great difficulty, and respond well to nonoperative treatment. The complications of the disease which require surgical attention include free perforation into the peritoneal cavity, abscess, fistula, and obstruction. Blood in the stools or

TABLE II.—*Symptoms and Signs of Diverticulitis of Sigmoid in 34 Cases in Which Surgery Was Performed.*

Symptoms or Signs		Cases	Per Cent of 34*
Inflammation		23	67.6
Intestinal obstruction, complete or partial		11	32.4
Diarrhea		7	20.6
Hemorrhage		4	11.8
Mass		17	50
Abdominal	6		
Pelvic	9		
Both	2		
Fistula		3	8.8
Sigmoidal cutaneous	1		
Sigmoido vesical	2		

* Right colon cases eliminated. One case eliminated with only closure colostomy. Many cases showed more than one of above findings.

severe hemorrhage occurs in about 15 per cent[17] of the cases (11.8 per cent of this series) and requires close differentiation to rule out carcinoma. Jones[23] advocated operation in all cases showing hemorrhage for fear of missing carcinoma. As has been pointed out, the diagnosis of carcinoma cannot be eliminated in many cases either clinically or by roentgen ray. Other patients are operated on under the mistaken diagnosis of tumors arising from the female pelvic organs.[24]

TABLE III.—*Results of Preoperative Barium Enema Examination in 24 Cases of Complicated Sigmoid Diverticulitis.*

Xray Findings		Cases
Diverticulitis		14
With perforation	4	
Carcinoma		2
Possible carcinoma		7
Obstruction		6
Narrowing with pericolic mass		1
Spasm of sigmoid only		3
Negative		1

Schatzki[25] pointed out that barium enema permits accurate diagnosis in most cases of diverticulitis, but that difficulty in differentiating carcinoma is not uncommon and occasionally impossible. Preoperative barium enema was carried out in 24 cases of sigmoid diverticulitis. Table III shows the findings reported. Carcinoma was definitely diagnosed in two and mentioned as a possibility in seven others. Sigmoid obstruction was encountered in six cases and narrowing of the sigmoid with pericolic mass in one other. Spasm of the sigmoid was the important notation in three. In one case the barium enema

was reported as negative. Diverticula and evidence of diverticulitis were noted in 14 cases, four of which showed perforation with extravasation of barium outside the lumen of the bowel.

Sigmoidoscopic examination was of little diagnostic aid. It was performed in 12 cases, with negative findings in six. Obstruction was demonstrated in five cases. One of these showed an ulcerated area at the site of obstruction, biopsy of which was reported benign on two occasions. In another case showing obstruction, a benign polyp was found distal to the obstruction. Early ulcerative colitis was mistakenly diagnosed in one case.

Table IV lists the preoperative diagnoses taken from the operative records of the cases of sigmoid diverticulitis in the present series. Only seven cases

TABLE IV.—*Preoperative Diagnosis in 34* Cases Recorded at Time of Surgery and in 9 Cases in Which Resection Was Performed at Subsequent Stage.*

Preoperative Diagnosis	Primary Operation		Subsequent Surgery Except Colostomy Closure	
	Cases	Per Cent	Cases	Per Cent
Diverticulitis..........................	7	20.6	3	33.3
Carcinoma of colon....................	5	14.7	2	22.2
Diverticulitis? Carcinoma?.............	10	29.4	4	44.4
Pelvic tumor..........................	7	20.6		
Abdominal or pelvic abscess............	5	14.7		
Total...............................	34	100	9	100

* One case, entering for closure of colostomy only, has been eliminated.

were correctly diagnosed before the primary operation. Some form of pelvic tumor was the preoperative diagnosis in seven cases. Carcinoma was the unqualified diagnosis in five cases, and could not be ruled out in an additional ten. Thus, in 44.1 per cent, primary operation was undertaken early because of the mistaken possibility of cancer of the bowel. It is of interest to note that in nine cases, at the time of second stage operations other than colostomy closure, the preoperative diagnosis included the possibility of carcinoma in six. This emphasizes the difficulty in gross pathologic differentiation at the operating table.

OPERATIVE TREATMENT

The operative procedures carried out on the 37 patients in this series are of interest. As mentioned above, one case of sigmoid diverticulitis returned two years after resection of the sigmoid with an acute perforation of a diverticulum of the ascending colon. This patient has been included twice in this series, bringing the total cases treated to 38.

Of the three patients with involvement of the right colon, two suffered acute perforations and, as emergencies, underwent one stage right colectomy with ileotransversostomy. They were discharged ten and 19 days following resection and have remained well 13 and 17 months postoperatively. One complained of occasional mild diarrhea following operation.

The third patient was admitted with a retroperitoneal abscess posterior

to the cecum, having previously been operated on elsewhere because of a right subdiaphragmatic abscess. Following drainage of the retrocecal abscess a fecal fistula developed. Barium enema revealed diverticula of the cecum and transverse colon with a fistula from the cecum. Right colectomy was performed two months later. A residual sinus persisted which required treatment for 18 months before it finally closed. The patient was in good health eight years following resection.

In the remaining 35 cases the disease involved the sigmoid. In six of these, operative treatment other than resection was carried out. Table V lists the type of operation and the late results in these conservatively treated patients. In three cases, classified as not well, resection was later necessary, one because of a persistent fecal fistula and two because of recurrent bouts of severe diverticulitis. Three patients recovered without further operation. In

TABLE V.—*Operations Other Than Resections for Diverticulitis of Sigmoid Colon. Postoperative Complications and Late Results.*

Operations	Cases	Deaths	Postoperative Complications*		Late Results	
			Cases	Number	Living & Well	Not Well
Drainage of abscess.....................	3	0	1	1	1	2
Drainage of abscess with colostomy— later closure........................	1	0	1	1	1	0
Release small bowel obstruction due to adhesions...........................	1	0	0	0	0	1
Closure colostomy only................	1	0	0	0	1	0
Total.............................	6	0	2	2	3	3

* Two cases of incisional hernia.

one, drainage of a large perisigmoidal abscess was performed. A resulting sinus closed and reopened, due to recurring abscess, twice within six months, following which it healed. The last report revealed the patient to be well seven years from the date of operation. In another patient a · large pelvic abscess was drained and colostomy performed because of obstruction at the rectosigmoid. The colostomy was closed three months later, the patient remaining well without recurrence 19 years thereafter. The third patient entered for closure of a transverse colostomy performed elsewhere. Roentgen evidence of diverticulitis had entirely disappeared. Follow-up reports revealed the patient to be in good health without recurrent disease five and a half years after closure of the colostomy. This experience corroborates the reports of others[17, 19] that surgical intervention short of resection yields a high recurrence rate.

Table VI delineates the operative treatment of 31 patients on whom various methods of resection were carried out. One patient on whom two resections were done has been omitted from this chart because her course was too complicated to permit tabulation. The details of her treatment, which resulted in complete failure, will be briefly outlined later. The patients listed in Table V as not well, later requiring resection, are included in Table VI.

Twenty-one patients were treated by primary resection and end-to-end anastomosis, ten with complementary cecostomy and ten without cecostomy. One of the latter was complicated by the development of a fecal fistula. Transverse colostomy was carried out three weeks later. The fistula promptly healed, permitting colostomy closure three months thereafter. One patient, with involvement of the rectosigmoid, was explored as an emergency under a mistaken diagnosis, a pelvic abscess found, and resection and end-to-end anastomosis with complimentary transverse colostomy performed. The colostomy was closed two months later.

TABLE VI.—*Resections—All Methods—For Diverticulitis Left Colon—Including Post-operative Complications.*
Late Results (Followed 1 to 16 Years)
Early Results (Followed Less than 12 Months Postoperatively)

Type of Operation	Cases	Deaths	Postoperative Complications		Late Results		Early Results	
			Total Cases	Number	Living & Well*	Not Well	Living & Well†	Not Well
PRIMARY RESECTION......................	21	0	5	9	15	0	5	1
End to End Anastomosis								
With complementary cecostomy...... 10								
With complementary colostomy and later closure colostomy........... 2								
Without complementary cecostomy or colostomy...................... 9								
MIKULICZ (OBSTRUCTIVE) RESECTION........	3	0	1	1	3	0	0	0
Second stage closure of resulting colostomy								
TWO STAGE LEFT COLECTOMY..............	1	0	1	1	0	0	1	0
Resection descending and sigmoid colon—proximal loop exteriorized and closure distal stump								
Mobilization transverse colostomy and anastomosis to rectosigmoid—complementary cecostomy								
THREE STAGE RESECTION...................	6	0	2	5	4	0	2	0
Transverse colostomy								
Resection and end to end anastomosis								
Closure colostomy								
Total..............................	31	0	9	16	22	0	8	1

* Three subsequent deaths—unrelated cause.
† One subsequent death—unrelated cause. One death—cause and date unknown.

It is worthy of note that all cases with complementary cecostomy were treated prior to 1943. Only two of the ten cases resected without cecostomy were treated before this date, the remaining eight having been operated on since 1946. No cecostomy required closure. The value of cecostomy as an adjunct to resection is difficult to ascertain from the case records. It is doubtful that it would have been adequate protection in the patient who developed leakage at the suture line. As will be mentioned later, the short segment resected in this case was more likely the cause of this complication. That cecostomy has been discarded in recent years may be significant.

Mikulicz resections were performed in three cases, all prior to 1937. The indications for this procedure were not clear from the records. In one case,

partial obstruction was the obvious reason for this choice. Severity of the process was no greater in the other two than in many subjected to one stage resection. The location of the lesion to permit exteriorization of both ends following resection was certainly not the deciding factor, since in only five of the primary one stage resections was the rectosigmoid involved. The remainder were located high enough to permit obstructive resection had the surgeon desired.

Three-stage operations (transverse colostomy, resection and end-to-end suture, and closure of colostomy) were carried out on six patients. All of these have been done since 1944. In four cases, the indication for the preliminary colostomy was obstruction. Inadequate bowel preparation was the reason for colostomy in one case operated on as an emergency under a mistaken diagnosis. In one case barium enema revealed a large extracolic cavity, the result of perforation of a diverticulum. Preliminary colostomy seemed wise.

The duration of these six colostomies prior to resection ranged from two to nine weeks, the average being just over four weeks. In five of these cases carcinoma was suspected, requiring early definitive surgery. In the sixth, in which a definite diagnosis of diverticulitis was made, resection was performed two weeks after colostomy. This patient was treated in October, 1948. The decision to carry out early resection was made in the light of past experience at the Clinic and is in sharp contrast to accepted teaching.

The remaining case tabulated in Table VI was that of a patient who had severe diverticulitis involving the sigmoid and descending colon. Perforation of the bowel had resulted in a large retroperitoneal abscess which extended over the entire left iliac fossa and adjacent lumbar area. This cavity filled with barium on roentgen examination. Drainage of this abscess resulted in a fecal fistula which necessitated further operation. The descending colon and extrapelvic sigmoid from a point three inches above the peritoneal reflection were resected. The distal stump of sigmoid was closed and the proximal limb at the splenic flexure brought out as a colostomy. Two and a half months later, anastomosis of the transverse colon to the pelvic sigmoid was accomplished, complementary cecostomy and sphincterotomy being added at the conclusion of the procedure. The patient was in good health, aside from an incisional hernia, when last seen six months thereafter.

LATE RESULTS

The late results of the resected cases also are included in Table VI. Twenty-two patients have been followed one year or more, the longest follow-up being 16 years. Three have died of unrelated causes. All of the 22 patients have been classified as living and well as far as diverticulitis is concerned. As previously mentioned, there was one complete failure in a resected case not included in the table because of difficulty in tabulation. Thus, 95.65 per cent of 23 patients who submitted to resection were cured of their disease. Of nine patients followed less than 12 months, only one is classified as unwell.

She was last seen seven and a half months following resection, at which time a sinus persisted in the abdominal wound. Her health was otherwise good. Two of the nine are known to be dead, one of unrelated disease five months following operation, and one, cause and date unknown.

Smithwick[17] mentioned the possibility that the type of anastomosis, aseptic or open, might have some bearing on complications and late results. He found that six out of seven patients in the Massachusetts General Hospital series who had either leakage at the suture line or late symptoms, had had aseptic end-to-end anastomoses. Only one patient in the present series had an aseptic anastomosis. No early or late complications resulted, the follow-up revealing perfect health four years and four months following operation.

TABLE VII.—*Comparison of Morbidity—Various Types of Resection for Sigmoid Diverticulitis.*

Type of Operation	Cases	Average Days Hospitalization	Average Duration Disability— Weeks*	Average Duration Colostomy Weeks
1. Resection without colostomy..............	19	30	5.3	0
2. Obstructive type of resection..............	4	100	18	11†
Mikulicz.......................... 3				
Two stage left colon resection........ 1				
3. Resections with complementary colostomy....	8	67	12	8.5
Colostomy made as first stage........ 6				
Colostomy at time of resection........ 1				
Colostomy after primary resection..... 1				
Total cases with colostomy...................	12	78	14	9
(Groups 2 and 3 above)				

* From first admission to final discharge from hospital—many having more than one hospital admission.
† This figure an estimate, since one colostomy was not closed but simply clamped on two occasions. Duration of colostomy in this case has been calculated to the date of second clamping, it being assumed that closure could have been accomplished on that date.

The patient not included in Table VI was first seen on November 18, 1943, with a fecal fistula which followed an exploratory operation elsewhere one year before. Her past history included two previous laparotomies, appendectomy and hysterectomy. While a patient at the Clinic she was operated on seven times, as follows: (1) December 23, 1943. Fistula communicating with sigmoid closed; bladder accidentally opened and closed; transverse colostomy. (2) January 19, 1944. Recurrent fistula closed; pelvic abscess drained. (3) March 1, 1944. Closure of vesicosigmoidal and sigmoidal-cutaneous fistulas. (4) June 19, 1944. Resection of sigmoid, end-to-end anastomosis. (5) July 13, 1944. Colostomy closure. (6) July 29, 1944. Transverse colostomy because of recurrent sigmoidovesical fistula. (7) June 25, 1945. Resection of sigmoid, end-to-end anastomosis; repair of bladder. The vesicosigmoidal fistula recurred again and was still present when the patient was last seen on January 7, 1947. Sigmoidoscopy at that time revealed a severe stricture at the site of anastomosis, 14 cm. above the mucocutaneous line. From study of the many operative reports, it is obvious that severe diverticulitis, originally

complicated by extensive postoperative adhesive peritonitis, plus a tragic surgical accident have combined to yield this apparently hopeless result.

MORBIDITY

The immediate morbidity incident to the various types of resection should be of concern to both surgeon and patient. Table VII shows the average days of hospitalization as well as the duration of disability from the first admission to final discharge from the hospital in patients who were repeatedly hospitalized. This does not imply total disability before resumption of usual activity or occupation. These data were not available. Total duration of colostomy also has been included in the table. For this tabulation the complicated case mentioned above has been eliminated.

The duration of hospitalization in cases in which resection was done without colostomy was less than one-third that of the obstructive resection cases and less than one-half that following resection in which transverse colostomy was done preliminary to or as an adjunct to resection. When the two types of resection in which colostomy closure is necessary are combined the average hospital stay is more than two and a half times that of cases not requiring colostomy. The same comparison is apparent when the duration of disability is considered. Total duration of colostomy prior to closure in the two groups in which side-tracking operations were used varied from one to three months, the average for all cases being nine weeks.

POSTOPERATIVE COMPLICATIONS

A tabulation of postoperative complications is shown in Table VIII, and the number of patients suffering complications in each group of operative procedures is listed in Tables V and VI. Wound infection was difficult to ascertain from the records. Since many of the cases were drained at the time of operation, minor wound sepsis about the site of drainage or around cecostomy tubes has not been included as a complication. The listed complications occurred about equally in the various types of procedures. Five incisional hernias occurred, one of which was complicated by acute strangulation. Three of these hernias were later repaired. Altogether 19 complications occurred in 12 patients.

Postoperative barium enema studies were obtained in 18 cases of sigmoid diverticulitis. Six of these were performed in the early postoperative period, within two months or less of resection. Obstruction was found in none, irregularity or deformity at the suture line being described in four. In one case, a small tract outside the lumen of the bowel was demonstrated two and a half weeks after resection and prior to closure of the colostomy. Thirteen patients were examined months or years after operation. No evidence of obstruction was found in any of these. Deformity at the site of colostomy closure following a Mikulicz type of resection was described in one. In seven cases, diverticula were noted. Spasm was present in four cases. Late examinations in all

patients were done merely for check-up. None were carried out because of recurrent symptoms.

PATHOLOGY

Review of the pathologic reports in the cases of sigmoid diverticulitis revealed evidence of acute or subacute inflammation in 20 cases. Suppurative changes were present in 13 cases, mesenteric abscesses being described in nine. Ulceration was noted in two cases, fistulas in three, and stricture in one. The pathologic diagnosis in nine cases was simply diverticulitis or diverticulitis with perisigmoiditis, the type of inflammation not being mentioned. Chronic diverticulitis alone was diagnosed in two cases, multiple diverticula without evidence of inflammation in one.

TABLE VIII.—*Postoperative Complications—All Cases of Sigmoid Diverticulitis—19 Complications Occurring in 12 Patients.*

Complication		Number
Pulmonary		2
Pneumonia	1	
Pneumonia with effusion	1	
Vascular		2
Femoral phlebothrombosis	1	
Pulmonary embolus	1	
Cardiac		2
Coronary thrombosis	1	
Cardiac decompensation	1	
Urinary		2
Cystitis—severe	1	
Vesicosigmoidal fistula due to bladder injury	1	
Wound complications		9
Evisceration	1	
Wound infection—severe	1	
Postoperative sinus	1	
Fecal fistula	1	
Incisional hernia	5	
Paralytic ileus	1	1
Suppurative arthritis (knee)	1	1

Smithwick[17] suggested that more extensive resections, judged by the length of the specimen, resulted in better end results. He reported that in the cases showing leakage at the suture line less extensive resections had been performed. The average length of the resected segment reported by Smithwick was 13.6 cm., with 85 per cent of the cases ranging 15 cm. and below. In only four cases was a longer segment removed. The length of the resected segments in the present series was available from the pathologic reports in 31 cases. The average length was 14.5 cm., very little greater than that reported by Smithwick. In 22 cases (71 per cent) the specimens measured 15 cm. or less, averaging 11.0 cm. However, in nine cases the resection was 18 cm. or longer, the average being 23.2 cm. In these cases the operative note signified a more extensive process, although the pathologic changes were no more severe than in the specimens of shorter length. A comparison

between the length of the resected segment in the one stage resections and in the three stage resections revealed no significant difference. The Mikulicz resections measured 12, 22, and 34 cm.

This slight difference in the present series compared with that reported by Smithwick[17] certainly cannot be construed as the reason for the improved percentage of late results. The somewhat greater length in this series is more likely the result of operation carried out in an earlier stage of the disease, before the acute process had resolved. However, it is significant that in the one failure in the group, the resected specimen measured only 5 cm. This was one of two specimens measuring 5 cm., and one of four cases in which the segment removed measured less than 10 cm. The second 5 cm. specimen was from the only case of primary resection with end-to-end anastomosis in which a fecal fistula developed postoperatively. These two cases tend to bear out Smithwick's conclusions in this regard.

<div align="center">DISCUSSION</div>

It is recognized that from any small series of cases absolute conclusions are scarcely justified. However, it would seem apparent from this study that re-evaluation of the surgical treatment of this disease is indicated. Pemberton et al.[19] and Smithwick[17] have shown that measures short of resection yield exceedingly poor late results and that many patients so treated must retain a permanent colostomy to remain free from symptoms. This is a serious matter to consider in dealing with a benign lesion. Smithwick[17] further pointed out that surgical intervention other than resection, including colostomy, does not lower the late mortality due to the disease. The operative mortality for resection reported by these authors is low. That of Pemberton and his associates[19] (2.7 per cent) is particularly significant since it represented a large series treated after 1940. This reduced mortality was approximately one-half that which they reported for resection of malignant lesions of the large intestine during the same period. In the present series there was no operative mortality and no late mortality due to the disease.

The cure rate following resection is infinitely better than after less radical surgery. Smithwick[17] reported 84 per cent of cases living and well, one to ten years following resection, while Pemberton et al.[19] stated that approximately 80 per cent were cured. In the present series, 95.6 per cent were well, one to 16 years after resection. In view of these facts it seems obvious that a bold attack on the complicated case of sigmoid diverticulitis is not only justified but definitely indicated. Once surgery becomes necessary, resection should be the ultimate goal.

The present review not only confirms the above conclusions but raises certain other questions for rediscussion. The great majority of the 32 cases undergoing resection were operated on promptly after preliminary study. As previously indicated, three cases required resection after less definitive operation failed. Two of these patients had recurrent acute attacks and were primarily resected promptly upon readmission for the acute recurrence. The

other underwent primary resection for a fecal fistula which followed drainage of an abscess. Of the total cases, 25 were primary resections, preliminary colostomy being performed in the remaining seven. The average duration prior to resection of six of these colostomies was four weeks, the longest nine weeks, in contrast to the customary delay of three to 12 months. The resultant reduction of morbidity was striking. The average total duration of all colostomies, including those resulting from obstructive resections (excluding permanent colostomy in one patient) was only nine weeks. The dictum that colostomy should be maintained three to 12 months prior to definitive surgery is certainly open to question.

This radical departure from accepted teaching will undoubtedly be questioned. After reviewing the case records and in light of present concepts, the author believes that some of the patients might have been treated with greater safety had preliminary drainage or colostomy been instituted, delaying the attack on the diseased segment until more adequate preparation of the patient had been accomplished. However, serious criticism of the treatment employed is scarcely justified in view of the results obtained.

In the light of the series of cases under discussion it would seem reasonable to outline a plan of therapy which will afford the patient stricken with severe and complicated diverticulitis of the sigmoid colon the safest opportunity for early recovery. One must conclude that preliminary colostomy in many cases is not only unnecessary but contraindicated considering the prolonged morbidity which it induces. Obviously, when complete obstruction complicates the disease diversion of the fecal stream is required. It commonly may be necessary when previous drainage of an abscess results in a fecal fistula. It is often indicated in general peritonitis resulting from acute perforation of a diverticulum of the sigmoid. It may be advisable for vesicosigmoidal fistulas which follow operation or are associated with pelvic abscess. However, spontaneous vesicosigmoidal fistula, in the absence of obstruction or abscess, need not necessarily demand colostomy. In the present series, two patients with this complication were treated by primary resection without colostomy. Both were discharged from the hospital on the seventeenth postoperative day, and have remained well two years and two months, and one year, respectively. When colostomy is indicated, it should be made at the level of the transverse colon. Sigmoid colostomy will seriously impede future resection.

An abscess following perforation of a diverticulum may resolve with antibiotic and chemotherapeutic treatment. However, many will require drainage. To delay operation in the hope that spontaneous drainage into adjacent bowel will take place as suggested by Hayden[26] is nothing short of procrastination. Transverse colostomy, as an adjunct to drainage, is indicated if obstruction is associated. Some cases will subside completely following simple drainage. However, those with persistent symptoms and certainly those with resultant fistula should be subjected to resection.

Cases not presenting the above complications may require operation because of suspected carcinoma or because of recurring acute episodes. The acute attack will generally subside with conservative management, including antibiotic and chemotherapeutic measures. Thereafter, with the bowel adequately prepared, exploration may be undertaken with the view toward primary resection. This commonly can be performed with safety.

When one is faced at the operating table with the disquieting realization that a suspected pelvic tumor is in reality a sigmoid or rectosigmoid diverticulitis, obstructive resection should be considered, depending upon the location of the lesion. With involvement of the rectosigmoid, primary resection and anastomosis with complementary transverse colostomy may seem a wise choice, depending upon the state of bowel preparation.

When resection is undertaken, the bowel should be divided several inches from the zone of inflammation to insure safe anastomosis and to avoid the complications which appear to follow the removal of a short segment. The type of anastomosis, aseptic or open, seems of little consequence provided the method chosen yields a wide stoma.

It is doubtful that complementary cecostomy is of any real value. If for any reason the integrity of the suture line is in question, complete sidetracking of the fecal stream is a much safer procedure. If, however, the anastomosis is not in doubt, cecostomy would seem unnecessary and merely complicates the postoperative course.

SUMMARY

A review of 20 years' experience (1929 to 1949) at The Portland Clinic in the surgical treatment of diverticulitis of the colon has been presented. A total of 38 cases have been tabulated. Three right colectomies have been performed for perforation of diverticula of the ascending colon and cecum. Thirty-two of 35 patients with diverticulitis of the sigmoid and rectosigmoid have undergone resections of the involved segment. Twenty-five primary resections and seven resections after preliminary colostomy are included. No operative mortality occurred.

Twenty-two of 23 cases (95.6 per cent) of sigmoid resections, followed one to 16 years, are classified as living and well. There has been no late mortality from the disease. All colostomies have been closed except in one patient who, because of persistent vesicosigmoidal fistula which recurred after repeated resections, carries a permanent colostomy.

The great reduction in morbidity in this series compared to other reports has been striking. The average duration of colostomy prior to resection was four weeks, while total duration of colostomy (excluding one permanent colostomy) averaged nine weeks.

In view of the low mortality following resection and in view of the high morbidity, high recurrence rate, and late mortality which follow less radical measures, a bold approach to this problem deserves serious consideration. Re-evaluation of the surgical therapy in complicated sigmoid diverticulitis is indicated.

BIBLIOGRAPHY

[1] Cole, W. H., and R. Elman: Textbook of General Surgery, 5th ed. 1948, D. Appleton-Century Co., New York, pp. 740–741.

[2] Homans, J.: A Textbook of Surgery, 6th ed. 1945, Charles C. Thomas, Springfield, Ill., pp. 949–950.

[3] Judd, E. S., and J. R. Phillips: Diverticulitis. Surg. Clin. North America, 14: 542, 1934.

[4] Graham, R. R.: Diverticulitis of the Sigmoid Colon. Canadian M. A. J., 36: 1, 1937.

[5] Brown, P. W., and D. M. Marcley: Prognosis of Diverticulitis and Diverticulosis of the Colon. J. A. M. A., 109: 1328, 1937.

[6] Stetten, DeW., and A. J. Abeloff: Observations on Clinical Picture and Therapy of Diverticulitis of Colon. J. Mt. Sinai Hosp., 4: 781, 1938.

[7] Lockhart-Mummery, J. P.: Late Results in Diverticulitis. Lancet, 2: 1401, 1938.

[8] Jones, T. E.: Diverticulitis and Diverticulosis of Colon. Surg. Clin. North America, 19: 1105, 1939.

[9] Brown, P. W.: The Treatment and Prognosis of Diverticulitis of the Colon. Am. J. Surg., 46: 162, 1939.

[10] Eggers, C.: Acute Diverticulitis and Sigmoiditis. Ann. Surg., 113: 15, 1941.

[11] Laufman, H.: Surgical Management of Diverticulitis of Colon: 5-Year Collective Review. International Abstr. Surg., 73: 222, 1941.

[12] Young, E. L., and E. L. Young, III: Diverticulitis of the Colon. A Review of the Literature and an Analysis of Ninety-One Cases. New England J. Med., 230: 33, 1944.

[13] Cave, H., and W. E. Alsop: Diverticulitis of the Colon. Surg. Clin. North America, 26: 390, 1946.

[14] Morton, J. J., Jr.: Diverticulitis of the Colon. Ann. Surg., 124: 725, 1946.

[15] Rankin, F. A., and A. S. Graham: The Colon and Rectum, in F. W. Bancroft and P. A. Wade: Surgical Treatment of the Abdomen. 1947, J. B. Lippincott, Philadelphia, p. 750.

[16] Babcock, W. W.: Diverticulitis. Rev. Gastroenterol., 8: 77, 1941.

[17] Smithwick, R. H.: Experiences with the Surgical Management of Diverticulitis of the Sigmoid. Ann. Surg., 115: 969, 1942.

[18] Martin, K. A., and C. G. Adsit: Diverticulosis and Diverticulitis: A Clinical Study of the Complications. Med. Clinics North America, 29: 639, 1945.

[19] Pemberton, J. deJ., B. M. Black and C. R. Maino: Progress in the Surgical Management of Diverticulitis of the Sigmoid Colon. Surg., Gynec. & Obst., 85: 523, 1947.

[20] Herrmann, S. F.: Surgical Problems in Diverticulitis of the Colon. West. J. Surg., 56: 572, 1948.

[21] Diverticulitis of Sigmoid, Cabot Case 28171; and Carcinoma of Sigmoid, Cabot Case 28172. New England J. M., 226: 695, 1942.

[22] Spriggs, E. I., and O. A. Marxer: Multiple Diverticula of the Colon. Lancet, 1: 1067, 1927.

[23] Jones, D. F.: Diverticulitis of the Colon. New England J. M., 203: 459, 1930.

[24] Allen, E., and L. B. Donaldson: Diverticulitis of the Colon in Gynecology. West J. Surg., 55: 393, 1947.

[25] Schatzki, R.: The Roentgenologic Differential Diagnosis Between Cancer and Diverticulitis of the Colon. Radiology, 34: 651, 1940.

[26] Hayden, E. P.: Surgical Problems in Diverticulitis. New England J. M., 222: 340, 1940.